DOCUMENT RESUME

ED 391 105 CE 070 808

AUTHOR Scruggs, Cathy A.
TITLE Tech Prep Q & A: Information for Program Development. Information Series No. 364.
INSTITUTION ERIC Clearinghouse on Adult, Career, and Vocational Education, Columbus, Ohio.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE 96
CONTRACT RR93002001
NOTE 71p.
AVAILABLE FROM Publications, Center on Education and Training for Employment, 1900 Kenny Road, Columbus, OH 43210-1090 (order no. IN364, $8; quantity discounts).
PUB TYPE Information Analyses - ERIC Clearinghouse Products (071)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Articulation (Education); Educational Change; Educational Cooperation; *Education Work Relationship; High Schools; Integrated Curriculum; Postsecondary Education; *Technical Education; *Tech Prep; Vocational Education

ABSTRACT

In the 1990s, the changes brought about by technology, the global economy, and demographics have necessitated the reform of educational systems. One response, given impetus by federal legislation, is tech prep, an articulated secondary-postsecondary program that provides technical preparation in an occupational field, integrates academic and vocational education, and leads to placement in employment. This paper poses questions and offers answers from the literature regarding tech prep as an educational reform approach. The queries address major issues concerning tech prep strategies, processes, teams, and evaluation and planning. The answers offer a practical response, example, or consideration. The introduction presents the tech prep vision and why it is needed. The next section addresses strategies that are proving effective, their target audience, and how they should be implemented. The importance of tech prep processes, including the establishment of performance standards, professional teacher development, and collaboration with employers is discussed. Teamwork as an essential ingredient in tech prep success is highlighted, including the involvement of all stakeholders from business, industry, labor, education, and the community in planning, curriculum development, and evaluation. The role of evaluation and planning in consortia and at the state level is described. The last section considers the future of tech prep and why it should continue, providing a checklist of questions that can be used to assess existing programs and guide their future development. (SK)

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Information for Program Development

Information Series No. 364

Cathy A. Scruggs

U.S. DEPARTMENT OF EDUCATION
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Tech Prep Q & A:
Information for Program Development

Information Series No. 364

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ERIC Clearinghouse on Adult, Career, and Vocational Education
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Columbus, OH 43210-1090

1996

Funding Information

Project Title:	ERIC Clearinghouse on Adult, Career, and Vocational Education
Contract Number:	RR93002001
Act under Which Administered:	41 USC 252 (15) and P.L. 92-318
Source of Contract:	Office of Educational Research and Improvement U.S. Department of Education Washington, DC 20208
Contractor:	Center on Education and Training for Employment The Ohio State University Columbus, Ohio 43210-1090
Executive Director:	Ray D. Ryan
Disclaimer:	This publication was prepared pursuant to a contract with the Office of Educational Research and Improvement, U.S. Department of Education. Contractors undertaking such projects under government sponsorship are encouraged to express freely their judgment in professional and technical matters. Points of view or opinions do not, therefore, necessarily represent official U.S. Department of Education position or policy.
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Foreword

The Educational Resources Information Center Clearinghouse on Adult, Career, and Vocational Education (ERIC/ACVE) is 1 of 16 clearinghouses in a national information system that is funded by the Office of Educational Research and Improvement (OERI), U.S. Department of Education. This paper was developed to fulfill one of the functions of the clearinghouse—interpreting the literature in the ERIC database. This paper should be of interest to career and vocational education practitioners and students.

ERIC/ACVE would like to thank Cathy A. Scruggs for her work in the preparation of this paper. Ms. Scruggs is Tech Prep Curriculum Specialist at the Center on Education and Training for Employment (CETE), the Ohio State University. She created Ohio's Tech Prep Competency Profile Process and coordinated the development of a national strategic plan for tech prep. Formerly, she directed the Vocational Instructional Materials Laboratory at CETE, and she has served as a home economics regional supervisor, teacher, and curriculum editor. She recently received the Outstanding Young Professional Award from the Florida State University College of Human Sciences.

The following people are also acknowledged for their critical review of the manuscript prior to publication: Walter Edling, Vice President, Service Programs, Center for Occupational Research and Development (CORD); Darrell Parks, Director, Work Force Education, CORD; Richard J. Miguel, Assistant Superintendent, Illinois State Board of Education; and Ray D. Ryan, Executive Director, CETE.

Publication development was coordinated by Susan Imel. Sandra Kerka edited the manuscript, and Janet Ray served as word processor operator.

Ray D. Ryan
Executive Director
Center on Education and Training
for Employment

Executive Summary

In the 1990s, the changes brought about by technology, the global economy, and demographics have necessitated the reform of educational systems. One response, given impetus by federal legislation passed in 1990, is tech prep, an articulated secondary-postsecondary program that provides technical preparation in an occupational field, integrates academic and vocational education, and leads to placement in employment. This paper poses questions and offers answers from the literature regarding tech prep as an educational reform approach. The queries address major issues concerning tech prep strategies, processes, teams, and evaluation and planning. The answers offer a practical response, example, or consideration for program development.

The introduction presents the tech prep vision and why it is needed. Next, strategies that are proving effective, their target audience, and how they should be implemented are addressed. The importance of tech prep processes, including the establishment of performance standards, professional teacher development, and collaboration with employers is discussed.

The next section highlights teamwork as an essential ingredient in tech prep success, including the involvement of all stakeholders from business, industry, labor, education, and the community in planning, curriculum development, and evaluation. The role of evaluation and planning in consortia and at the state level is described.

The last section considers the future of tech prep and why it should continue, providing a checklist of questions that can be used to assess existing programs and guide their future development.

Information on tech prep may be found in the ERIC database using the following descriptors: *Articulation (Education), *Education Work Relationship, Educational Change, Educational Cooperation, Integrated Curriculum, Postsecondary Education, Secondary Education, *Tech Prep, *Technical Education, Vocational Education. Asterisks indicate descriptors that are particularly relevant.

Background

This paper poses questions and offers answers regarding tech prep as an educational reform approach. The queries represent major questions regarding tech prep strategies, processes, teams, and evaluation. Each answer offers either a practical response, example, or concern to be considered in program development. These answers are not intended to be definitive, but to provide food for thought. The composite should be of interest to employers, parents, teachers, administrators, curriculum specialists, counselors, placement directors, college and university faculty, and researchers alike as it relates to the implications of tech prep across the continuum of educational practice. Figure 1 depicts the logic sequence for this paper. This first section provides background information on the rationale for tech prep.

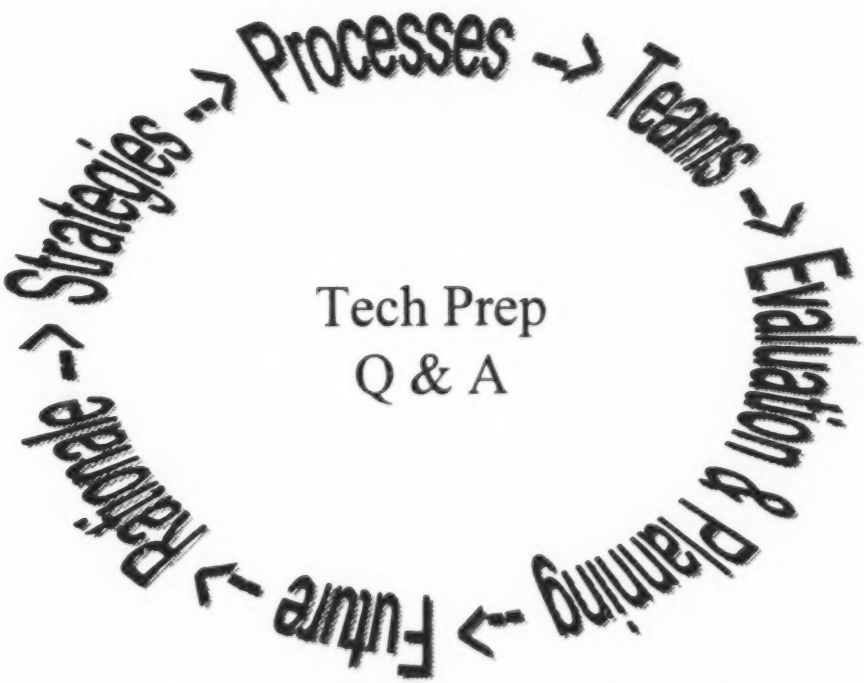

Figure 1. Tech prep: Information for program development

The Rationale for Tech Prep: Vision and Need

In 1985, Dale Parnell's ***The Neglected Majority*** called on the United States to transform its educational system. Parnell proposed that a Tech Prep Associate Degree (TPAD) was needed to serve high school students who wander aimlessly along the path to the nowhere zone (i.e., low skills = low wages). He provided enough ideas, rationale, and structure to cause hundreds of pioneers to plant tech prep "seedlings" in many communities across the nation. Some of the tech prep seedlings took root and began to grow tall and strong. Other seedlings survived, but had to be staked and kept under close watch. A few of the seedlings withered and died. So, the pioneers began to query how they could ensure that the seedlings would grow into mature tech prep trees. Was more human intervention required? What about adding more water or fertilizer? Should the seedlings be planted in groves? Would they grow in clay? Could they survive a drought? How much wind could the seedlings withstand? Should they be pruned? How often? Would Miracle Gro™ help?

As time passed, the seedlings grew and Congress began to take notice of the surviving, but scattered tech prep trees. In 1990 the Carl D. Perkins Vocational and Applied Technology Act was passed, providing federal funds for the planting of tech prep trees in every state in the nation. The Tech Prep Education Act, Title III, Section 347 of P.L. 101-392 describes tech prep education as "a combined secondary and postsecondary program which (1) leads to an associate degree or two-year certificate; (2) provides technical preparation in at least one field of engineering technology, applied science, mechanical, industrial, or practical art or trade, or agriculture, health, or business; (3) builds student competence in mathematics, science, and communications (including through applied academics) through a sequential course of study; and (4) leads to placement in employment."

In a September 1990 address to the House, former U.S. Representative William Ford of Michigan—"author" of the Tech Prep Education Act—did not tinker around the edges, use buzzwords, or suggest doing the same things better. Ford (1991) said:

- The work force of the future will need increasing levels of technical skills.

- High school vocational education, even when done well, does not provide a sufficient level of skills for most of the jobs of the future.

- Training in the skills to get a good first job is not enough. They must be able to grow and change with the evolution of technology and the world economy.

- Although most young people will need to continue their education beyond high school, the secondary and postsecondary educational systems frequently do not mesh smoothly.

- A great many high school students, particularly those in general education curriculum, have no clear path either into further education or into the work force. What is needed is a broader approach; one that is consistent with the reality that workplace needs continue to change and that learning throughout one's life is essential. (pp. 5-6)

The Information Age demands a new breed of student, worker, and citizen—a lifelong learner who can access, analyze, and use information to solve problems and devise creative ways to add to the "whole" organization.

Ford was referring to systemic synergy—the combining of parts into a whole that has united action(s). Achieving systemic synergy is not a top-down or bottom-up process; it is all encompassing. Yet, for many decades the nation's schools have been bombarded with one educational reform after another—leaving an attitude of complacency in their wake. Is tech prep just another educational reform that will perpetuate the public (K-16) school system's "business as usual" attitude?

Just as manufacturing systems have converted from quantity-driven assembly lines to just-in-time production for high quality markets, so must educational systems convert from being mass producers of content specialists to becoming high quality facilitators of information synthesizers. The "Information Age" demands a new breed of student, worker, and citizen—a lifelong learner who can access, analyze, and use information to solve problems and devise creative ways to add to the "whole" organization. Tech prep's goal is to produce individuals who are such students, workers, and citizens.

To support economic growth, business and industry need technicians who have the basic skills, broad systems grounding, and intellectual flexibility to think on their feet, learn on the job, and undertake ongoing training as work and technology change. However, more and more students are entering the workplace lacking the knowledge and technical skills they need to meet the job demands brought about by advanced technology and a global market. Section 342 of the Tech Prep Education Act of 1990 sets forth a number of reasons for tech prep:

- Rapid technological advances and global economic competition demand increased levels of skilled technical education preparation and readiness on the part of youths entering the work force.

- Effective strategies reaching beyond the boundaries of traditional schooling are necessary to provide early and sustained intervention by parents, teachers, and educational institutions in the lives of students.

- A combination of nontraditional school-to-work technical education programs, using state-of-the-art equipment and appropriate technologies, will reduce the dropout rate for high school students in the United States and will produce youths who are mature, responsible, and motivated to build good lives for themselves.

- The establishment of systematic technical education articulation agreements between secondary schools and postsecondary educational institutions is necessary for providing youth with skills in the liberal and practical arts and in basic academics, including literacy instruction in the English language, and with the intense technical preparation necessary for finding a position in a changing workplace.

- By the year 2000 an estimated 15 million manufacturing jobs will require more advanced technical skills, and an equal number of service jobs will become obsolete.

- More than 50 percent of jobs that are developing will require skills greater than those provided by existing educational programs.

- Dropout rates in urban schools are 50 percent or higher, and more than 50 percent of all Hispanic youth drop out of high school.

- Employers in the United States pay an estimated $210 billion annually for formal and informal training, remediation, and lost productivity as a result of untrained and unprepared youth joining, or attempting to join, the work force.

In sum, the realities of the workplace in the late 20th century indicate the need for tech prep, an approach that provides comprehensive, systematic, articulated technical and applied academic education. The sections that follow explore some areas of program implementation—strategies, processes, teams, and evaluation and planning—that can help developers ensure the effectiveness of their tech prep efforts.

Tech Prep Strategies

Q: What Are Some Effective Tech Prep Strategies?

A: Strategies for implementing tech prep have evolved during the past decade. Figure 2, based on Hull and Parnell (1991), represents a synopsis of the three major strategies for providing students more advanced education and training opportunities prior to the passage of the federal legislation authorizing tech prep in 1990. The strategies in figure 2 represent the conceptual thinking of early tech prep programs and are based on the work of the pioneers who actually tried these three different approaches. The first, *Advanced placement* or *time shortened*, reduces the time spent in postsecondary education by granting students advanced placement in postsecondary programs and eliminating coursework redundancy. The second strategy, *advanced skills*, does not reduce the time but does offer students advanced training at the secondary level with reduced coursework redundancy and exposure to higher-level occupational skills. *Apprenticeship*, the third strategy, offers students an alternative in the form of advanced training outside the traditional postsecondary educational setting and the advantage of at least 2 years of apprenticeship training after high school leading to a certificate.

Strategy	**Advanced Placement** (Time Shortened)	**Advanced Skills** (Higher Occupational Skills)	**Apprenticeship** (Worksite Training)
Features	Eliminates unnecessary redundancy Grants advanced placement in postsecondary programs Allows students to complete postsecondary programs in less time	Eliminates unnecessary redundancy Adds more advanced training with high-technology emphasis Allows students to complete postsecondary programs with advanced level skills	Combines academic instruction with work-based learning Provides advanced technical training

Figure 2. Tech prep strategies

As tech prep really began to grow, these three approaches provided guidance to consortia across the United States. Each were variations on what Parnell (1985) had termed the Tech Prep Associate Degree (TPAD) Model, which designates the associate degree as the preferred credential for tech prep.

Another conceptualization of tech prep strategies is presented in Table 1, developed by Bragg (1994). The strategies shown represent a synthesis of the work done by Bragg and her colleagues over several years (see Dornsife 1992a; Dornsife 1992b; and Dornsife and Bragg 1992). Table 1 outlines the key features of these five strategies or approaches by comparing six fundamental components.

- **Pre-Tech Prep** affects only grades 11-12 and 2 years of college (vertical articulation). Bragg notes that this model does not affect students who often drop out of high school prior to grade 11.

- **Adult Tech Prep** is designed for adult students enrolled in 2-year colleges who do not have adequate high school preparation; it is sometimes referred to as "bridge" programs—another confusing and widely interpreted term in tech prep.

- **Integrated Tech Prep** revolves around plans developed by interdisciplinary teams. The plans specify comprehensive academic and vocational integration as the core curriculum of tech prep. This category also encompasses Career Academies or Career Cluster approaches.

- **Work-Based Tech Prep** is not restricted to a school-based approach; it is discussed in conjunction with the School-to-Work Opportunities legislation. This category demonstrates forward thinking on the part of some tech prep consortia toward the school-to-work concept.

- **Tech Prep Baccalaureate Degree (TPBD)** has the associate degree as the midpoint in accomplishing a bachelor's degree. Bragg notes the difficulty of accomplishing this due to varying admission requirements and failed articulation among applied-associate degrees (currently viewed by 4-year institutions as terminal) and bachelor degree-granting institutions.

Table 1
Key Features of Tech Prep Models on Six Fundamental Components

Tech Prep Model	Articulated	Integrated & Authentic	School-to-Work Connected	Inclusive	Outcomes-Focused	Collaborative
Pre-Tech Prep	Formal agreements elementary to secondary to postsecondary	• Interdisciplinary, project-based • Team-centered cooperative learning	• Career awareness • Mentoring • Job shadowing	All students beginning in elementary or middle/junior high	Academic achievement & continuation in school	Collaboration to align and reform curriculum
Adult Tech Prep	Transition support from GED to postsecondary	• TPAD-type curriculum with SCANS • Interdisciplinary, project-based	• Supplement adults' regular employment with work-based learning	Provides access so nontraditional adult students can join all others in Tech Prep	• Program completion & employment • Individual assessment upon entry and exit	Collaboration to develop and support nontraditional adult students
Integrated Tech Prep	Formal agreements secondary to postsecondary	• Career academies • Occupational clusters/career paths • Authentic instruction	• Career awareness and exploration • Internships • Mentoring • Integrated work experiences	All students	• Academic & technical attainment, further education, & employment • Authentic assessment & program evaluation	• Interdisciplinary/ stakeholder teams • Formal partnering with B/I/L
Work-Based Tech Prep	Formal agreements secondary to postsecondary	• Career academies • Occupational clusters/career paths • Authentic instruction	• 2+2 youth apprenticeships • Cooperative ed. • Prof./clinical experiences • Formal apprenticeships	All students	• Academic & technical attainment, further education, & employment • Assessment and certification of industry standards	• Interdisciplinary/ stakeholder teams • Formal partnering with B/I/L
Tech Prep Baccalaureate Degree (TPBD)	Formal agreements secondary to 2-year and/or 4-year postsecondary	• Inverted curriculum design at postsec. level • Cooperative learning	• Cooperative ed. • Prof./clinical experiences	All students	Baccalaureate degree attainment & employment	• Collaboration to align and reform curriculum • Formal partnering and support from B/I/L

SOURCE: Bragg (1994), p. 5

Whereas Hull and Parnell's (1991) approaches represent the status of tech prep prior to the passage of tech prep federal legislation in 1990, those in Table 1 show the evolution of tech prep after the legislation was passed. The conceptualization of tech prep in Table 1 indicates that tech prep strategies are increasing; it also draws attention to adults as a population and to school-to-work programs that are not totally apprenticeship based.

The most recent conceptualization of tech prep, shown in Table 2, is based on the work of Hershey et al. (1995). The three models depicted emerged from the first phase of a national longitudinal evaluation of tech prep and they represent the progression in tech prep since Bragg (1994). The models can be described as follows:

- **Selective Occupations Tech Prep Model** highlights the high status received by tech prep when a clear distinction is made from traditional vocational education. It also points out that the greatest potential disadvantage is program quality maintenance when tech prep is expanded to less technology-oriented occupations. This model cites the advantage of creating common schedules for limited numbers of students.

- **Upgrade of Vocational Education Tech Prep Model** highlights the natural connection between tech prep and its birthplace—vocational-technical education. It also points out the greatest potential disadvantage is the stigma attached to vocational education.

- **General Systemic Reform Tech Prep Model** highlights serving students at all ability levels instead of limiting tech prep to the neglected majority, and the use of applied approaches to instruction with students at all ability levels. It also points out the greatest potential disadvantage as potentially missing the aim of the federal legislation.

Unlike Bragg (1994), the approaches shown by Hershey et al. (1995) do not indicate that tech prep is expanding. Rather, they have assigned all of the tech prep approaches currently found into one of three broad models. And, like Hull and Parnell (1991), they do not show possible overlap or linkage among the three.

Table 2
Tech Prep Models

	Perceived Advantages	Potential Disadvantages
Selective Occupations Tech Prep Model Consortia implement a few thoroughly defined tech prep programs of study, usually for high-tech occupations. Business and industry representatives are typically active partners in choosing the occupations and structuring the program. Students are carefully selected, although not strictly on the basis of grades, to maximize their chances of success in the math and science courses (which are typically more rigorous than what they might have otherwise taken).	**High Status.** Tech prep is clearly distinguished from traditional vocational education. Careful student selection and strong employers endorsement create a strong positive program image in the community. Students take pride in their special status.	Can program quality be maintained if tech prep is expanded into less technology-oriented occupations?
	Feasibility of Comprehensive Programs of Study. By implementing a limited number of programs, consortia can define programs and create common schedules for students.	What happens if consortia are less selective about students?
	Ease of Student Identification and Monitoring. Because students take a common sequence of classes, they can be readily identified and their progress charted.	Will an increase in the number of students participating undermine the program due to course scheduling problems?
Upgrade of Vocational Education Tech Prep Model Consortia focus on articulation and guiding vocational students into suitable applied academic courses when possible. Students may not identify closely with tech prep as a special program. The vocational and applied academic courses may differ somewhat from classes the students would have taken in the past, but most likely in ways students cannot readily identify as part of a new, higher-status program.	**Natural Achievement of Technical Focus.** Vocational education most naturally offers technically oriented programs.	Can improved vocational programs escape the stigma often associated with vocational education?
	Natural Grouping of Students. Students enrolled in particular vocational programs provide groupings for whom efforts to integrate academic and vocational instruction can be made.	Can master schedules be adjusted so that all vocational students take applied academic courses?
General Systemic Reform Tech Prep Model Consortia content that programs of study, career development activities, and applied approaches to instruction should be available to all students.	**Serves All Students.** Tech prep should apply to all students of all ability levels as they select a program of study or career cluster suited to their general career interests.	Was this the aim of federal policy and are tech prep resources being used as envisioned in the federal legislation?
	Applied Learning Techniques Incorporated into Academic Curricula. Applied approaches to instruction should be available to all students at all ability levels.	Can applied courses (most often offered as electives to traditional academic courses) really serve all students?

SOURCE: Hershey et al. (1995)

Although the strategies for tech prep represented in Hull and Parnell (1991), Bragg (1994), and Hershey et al. (1995) have their advantages and disadvantages, they represent a range of approaches that can be used in implementing tech prep. Certainly, these strategies have been successful in more than one setting and have been developed based on practices observed in the field.

Q: Who Should Be the Target of Tech Prep Strategies?

A: The primary focus of tech prep strategies is of course on preparing individuals for the work force. Tech prep must help students develop the capacity to think, learn, create, and succeed in a changing world by increasing their use of knowledge to grasp content, procedures, and problems in context. As John Dewey once said, "an ounce of experience is better than a ton of theory, simply because it is only as an experience that any theory has vital and verifiable significance . . . theory apart from an experience cannot be definitely grasped even as theory" (Dale 1972, p. 59). By combining both theory *and* practice, teachers can provide students with the academic and occupational skills needed to be employable. New entrants to the work force must be prepared to take the place of workers with critical technical skills. These contextual skills cannot be adequately developed through lecture, discussion, drill, or rote learning (the factory model of learning), but are best learned through realistic, practical applications. Learning does not look like a textbook—it surrounds you and becomes incorporated into your life.

Teachers are another focus of tech prep strategies. "As professionals, teachers cannot only teach—they must have time to learn and think, both about their students and about the content that they teach. We cannot ask teachers to support children in becoming reflective learners, yet give teachers no time for reflection themselves. We cannot expect teachers to nurture the intellectual life of our children without supporting them in having an intellectual life of their own" (Russell 1992, p. 18).

Tech prep must provide teachers with—

- professional development on topics pertinent to teaching and learning;

- the time, training, materials, and equipment needed to implement new teaching and learning techniques;
- follow-up assistance upon implementation of those new techniques; and
- connections among separate professional development events so that a complete picture of systemic change can be seen at secondary and postsecondary educational levels.

Tech prep strategies must also involve both education and economic stakeholders in multiple partnerships that foster a shared vision. "Reforms are strongest when they have a local flavor—when programs of integrated vocational and academic education focus on occupations and industries that are dominant in the community, when they draw upon student interests, when they forge links with local employers and community groups" (Grubb 1992, p. 78).

Q: How Should Tech Prep Strategies Be Implemented?

A: As tech prep is being developed, it must create a climate of public support. Informing and involving the public "along the way" will result in more local support and a better understanding of mistakes and unmet goals as the tech prep initiative moves forward. Frequent, community-wide conversations must be held among tech prep stakeholders (i.e., parents, students, teachers, counselors, educational administrators, and members of business, industry, and labor). This dialogue should be open to all opinions, respectful of all participants, and focused on identifying which parts of tech prep's vision have worked and the potential impact of that knowledge on other educational initiatives. For optimum results, stakeholder feedback needs to be (1) requested at the idea stage of an initiative; (2) received as soon as possible following actions; (3) part of an ongoing process; and (4) specific and accountable for guiding future behavior. If stakeholder reactions are positive, tech prep should build on those plans of action for the future. When stakeholder reactions are negative, tech prep should adapt those plans of action in order not to repeat errors.

To be implemented successfully, tech prep's vision must be shared by both education and economic partners. Schools and colleges produce the future work force. Business, industry, and labor is the consumer of education's product. Without all partners tech prep cannot be realized. To direct the change process, the Tech Prep Education Act specifies that tech prep be developed through consortia linking secondary and postsecondary education, business, industry, labor, government, and community-based entities. It also prescribes seven essential components for tech prep implementation:

1. formal, signed articulation agreements;
2. a core of required courses in mathematics, science, communications (including applied academics), and technologies in the 2 years of secondary school preceding graduation and 2 years of higher education or at least a 2-year apprenticeship following secondary instruction;
3. curriculum development;
4. inservice training for teachers;
5. training for counselors;
6. equal access for special populations to the full range of tech prep programs; and
7. preparatory services to help all populations participate in tech prep.

To be implemented successfully, tech prep's vision must be shared by both education and economic partners.

However, personal observations at national and state tech prep conferences and concentrated conversations with over 70 local tech prep coordinators raise a red flag—that a shared vision does not always exist below the surface. In countless cases, tech prep partnerships have been sacrificed due to turf battles, time constraints, and cost-benefit conflicts among individuals and/or organizations. Tech prep partners must address these issues or they will hear the cry: "See, tech prep went away just like all the others!"

to Siek and Hague (1992), turf battles can take place for several fundamental reasons, all related to the perceived effect on power:

- If one organization perceives the other as a direct and regular competitor for resources that are not likely to be shared
- If one organization perceives a "marginal cost" to the proposed cooperation in money, time, or energy greater than perceived benefits of collaboration
- The degree to which the organization feels it is flexible to change its current goals, tasks, and philosophy to adopt the course of action being proposed
- The lack of knowledge or mistrust of the other organizations
- If one party in a proposed relationship feels the exchange will be unequal (pp. 1-4).

Partnerships require environments in which each stakeholder is treated with constant respect, both individual and group contributions to the tech prep initiative are recognized, and conversations are held about implementation plans before action is taken. Parents, educators, and members of business, industry, and labor must jointly share responsibility for providing students with educational experiences that will lead to economic opportunities. Tech prep must continue to nurture the partnerships that have endured the 1990-1995 "planting season," for it is these sustained partnerships that will carry tech prep forward.

Q: Why Are Tech Prep Strategies Important?

A: Tech prep strategies are necessary in order to create an infrastructure for systemic educational reform that provides the resources of time, energy, personnel, materials, and money; builds capacity for local improvement; and eliminates bureaucratic constraints and provides the flexibility necessary to enable students to reach higher standards. All three of these points are

America's future will be no greater than the one we prepare our children to build. We must not handicap them with obsolete tools.

Frank Shrontz, The Boeing Company

being pursued by hundreds of tech prep consortia across this country, yet these infrastructures are far from stable. Based on collective experiences encountered to date, tech prep's viability hinges on the stability of the infrastructures at the local level. Even in states where tech prep leadership is strong, each community's level of commitment to continuous educational improvement, ability to rewrite policy, and procure and allocate resources, holds the key to institutionalization. It will take both time and deep commitment to stabilize systemic reform. Successful tech prep initiatives will not result from relabeling what is, but only by increasing standards across the fragmented secondary and postsecondary education delivery systems in order to meet the employment needs of business, industry, labor, and the community at large.

Tech Prep Processes

Q: What Are Some Essential Tech Prep Processes?

A: Essential tech prep processes revolve around ensuring employer access to well-qualified workers and establishing certification and performance standards. Employers need to be assured that workers will have the essential competencies when they begin employment and will continue to adapt and expand their productive capabilities throughout a working lifetime. Increasingly, traditional academic credentials do not provide this assurance. In addition, degrees and diplomas will continue to be replaced with precise instruments that certify attainment of competency. These "high-tech processes of certification will focus on screening in—identifying the nature and degree of specific shortcomings and leading directly to the most efficient learning resources needed to close the gaps and qualify people to perform the work they desire" (Perelman 1992, pp. 72-73). Employers must determine the knowledge and skills required to address labor market needs and assist Tech Prep in creating career credentials that report the accomplishment of that knowledge and skill to employers. These career credentials must portray achievement of competencies as proven by performance-based assessments that meet industry standards. Employers must also be willing to recognize these credentials as meeting their employment needs in a changing labor market.

Tech prep must also set performance standards that will equip students with the knowledge, skills, and attitudes needed for employment in technician-level positions, as well as the lifelong learning skills needed to retrain as job market requirements change. To accomplish this, tech prep must invest in the professional development of the nation's teachers, as suggested in the following excerpt:

> To help teachers understand how schools and work are linked, we propose expanded opportunities for all teachers to gain experience in business and industry in the summers or on the weekends. This first-hand experience

> of the expectations of today's workplace will invigorate the classroom curriculum and ensure its relevance to the world of work. In addition, the education of future teachers on our teacher preparation campuses must be cognizant of the needs of business and industry. . . . Future teachers need to be prepared to work with the wide range of student ability, interest, and direction. They also must be prepared to work with community and business leaders, labor leaders, and parents in helping to design and implement the most appropriate education for the youth in their classes. This plan will call for a major overhaul in the teacher preparation curriculum as well. (Grover 1991, p. 8)

Educators and representatives from business, industry, and labor must collaboratively agree on the knowledge and skills required to cross the bridge from school to work and to enter into a curriculum development partnership. The foundation of tech prep must be an interdisciplinary performance-based curriculum, developed through teamwork, that highlights integration between secondary and postsecondary education, as well as academic and vocational-technical education. The goal of tech prep is to prepare students for a lifetime of learning based on the competencies (i.e., knowledge, skills, and attitudes) necessary to meet employers' performance standards for credentialed technician-level positions.

Q: Who Should Be Involved in Implementing Tech Prep Processes?

A: Although tech prep processes must involve all stakeholders, the two key roles belong to counselors/admissions officers and teachers at both the secondary and postsecondary levels. "More than previous generations, today's students must learn to work collaboratively in teams, to solve problems, and to be flexible and adaptable. Yet our current (counseling and) teaching practices encourage students to work in isolation and compete with one another, to learn discrete facts and skills rather than to solve complex problems, and to follow fixed routines rather than to experiment with novel tasks. Preparing students for tomorrow's

workplace requires a different kind of (counseling and) teaching" (Kennedy 1992, p. 661). Tech prep must provide cohesive professional development for counselors and teachers that is structured around these principles: (1) learners are active receivers and providers of wisdom; (2) knowledge and skills should be acquired in context; (3) getting the right answer is not the purpose of learning; and (4) pieces of learning need to be seen as important to the whole.

Q: How Should the Implementation of Tech Prep Processes Work?

A: To implement tech prep, secondary school counselors and college admissions officers must be provided with career data that are current, credible, and easily explained to students and parents; and possess a desire to learn about changing labor market demands and the impact those changes have on the education and training requirements for job entry. They can then encourage students with technical interests and aptitudes to pursue performance-based courses of study that will measure their attainment of workplace skills and knowledge. Since preparation for tech prep should begin long before the 11th-grade entrance point, secondary school counselors have three key areas of responsibility:

- **Recruitment**—Tech prep is a program of study available to all students, including youth who are disadvantaged, minority, limited English proficient, handicapped, or dropouts—both males and females interested in pursuing technical careers. The counselor is central to making students aware of available tech prep options.

- **Retention**—Once accepted into tech prep, many students may need support services when problems interfere with their performance and progress, particularly during the transition from the secondary phase to the postsecondary phase. The counselor is the key to seeing that appropriate services are provided to secure retention.

- **Results**—Tech prep success will be determined by results shown in successful placement in a technical occupation, successful transfer to a technical degree program, and satisfaction of the program completer, the employer, and the college or university recruiter. The counselor can facilitate the groundwork for these desirable outcomes. (Warnat 1992)

Consequently, admissions officers at the postsecondary level need to assist in the promotion of credible career credentials that will be both reflective of current knowledge and skills needed by employers and recognized by business, industry, and labor as meeting the needs of a changing labor market.

Likewise, tech prep cannot be time bound by curriculum review cycles nor given cursory glances by advisory committees that are interested in maintaining the status quo. Tech prep consortia must collaboratively develop a performance-based curriculum in response to the needs of a moving labor market target and review or update it annually. The curriculum must include content common to all technologies such as computer skills, technology literacy, teamwork, employability skills, and professionalism. In Ohio, the *Tech-Prep Competency Profile Process* exemplifies this approach. It involves the following steps:

1. Analyzing area labor market data.

2. Defining exit occupations first at the end of the two-year degree or apprenticeship program, followed by identification of the high school exit occupations supporting those pursuits.

3. Convening consortium representatives from business, industry, and labor to identify competencies.

4. Convening consortium representatives from secondary and postsecondary education in the areas of communication, mathematics, and science for the purpose of examining technologies (identified by the exit occupations) to assign performance levels to each competency at biannual grade levels and query the clarity of the competencies identified by business, industry, and labor.

5. Reconvening both groups (mentioned in points three and four) together to (a) resolve questions regarding the competency list; (b) determine the education and training needs of faculty; (c) discuss delivery options for possible work-based and/or work site components; (d) identify material and equipment deficits within the consortium that would inhibit delivery; and (e) voice concerns regarding marketing to students, parents, counselors, other teachers, and administrators.

6. Forming committees who will develop the actual projects, problems, lessons, modules, courses of study, and eventually curriculum guides for the various components—some interdisciplinary, some integrated, some discipline specific—of the tech prep program.

7. Producing a composite tech prep curriculum "pathway" that alerts students, parents, and counselors of secondary and postsecondary course requirements.

The TCP Process provides a collaborative environment in which respect, recognition, and trust are nurtured among both secondary and postsecondary academic educators, vocational-technical educators, and business, industry, and labor representatives. By focusing attention on the development of a performance-based curriculum, synergy results from chaos and produces a level of understanding that is difficult to accomplish by other group processes.

Additionally, 11 of the 19 Tech Prep Roundtable/American Association of Community Colleges recommendations specifically address collaborative curriculum development (Falcone and Mundhenk 1994, pp. 10-18):

- Community colleges not already doing so should initiate curricular and pedagogical reforms appropriate to Tech Prep Associate Degree (TPAD) programs.

- Curricula for TPAD programs should integrate applied academic and technical education whenever possible.

- Instructors of academic courses should offer ample experiences that connect learning to the learners' communities, including work, politics, social issues, and institutions.

- Curricula for occupational courses should be predicated on the assumption that occupational instructors will teach beyond technical skills and will support the importance of academic education in preparing students for an occupation.

- Courses necessary to complete a technical specialization should be sequenced in order to ensure the attainment of higher-order skills.

- Entering adult students should be assessed to determine their knowledge and skill level relative to the technical program they select for study.

- Instructors in both academic and occupational programs should be provided with training that will enable them to utilize contextual learning techniques to maximize student understanding.

- Continuous, comprehensive staff development should be provided to community college career counselors, as well as other TPAD program staff.

- Occupational programs should be designed to achieve defined outcomes that address required technical, work, and other educational skills.

- Indicators of success should be developed for TPAD programs and a policy of periodic assessment should be adopted. Corrective action should be taken whenever phases of the TPAD program fail to achieve the levels of performance established by the indicators.

- Work-based learning should be carefully considered during the curriculum development or revision phase. When determined to be feasible, work-based learning opportunities should be tied to a carefully structured school-based tech prep course of study.

Q: Why Are Tech Prep Processes Important?

A: Tech prep realization requires the full integration of the academic and vocational-technical education components both in secondary and postsecondary settings. Technical workers do not differentially apply such acquired skills in the workplace, and educational institutions should be in concert with "real world" applications. The importance of integrating academic and vocational-technical education is well stated by Diana Walter (1992), Executive Director of the pioneering Partnership for Academic and Career Education (PACE) Consortium:

> Because of the comprehensive nature of what we think Tech Prep can and should be, and because of our philosophy that Tech Prep is not "just a vocational initiative," but an *educational* initiative, it will take years to fully implement the curriculum and counseling frameworks. . . . It's a permanent constantly evolving integration between levels of education and across disciplines . . . responsive to changes in the business and education communities. (p. 2-8)

The effectiveness of tech prep's career counseling and performance-based curriculum development efforts will determine its success as an educational reform initiative.

Hence, the effectiveness of tech prep's career counseling and performance-based curriculum development efforts will determine its success as an educational reform initiative. With an informed cadre of secondary school counselors and college admissions officers, as well as clear and consistent sets of standards and incentives that reward both secondary and postsecondary academic and vocational-technical educators, integration efforts will yield more than surface results.

Q: What Barriers Might Hinder Tech Prep Processes?

A: It is paramount that all students who hope to receive a respectable income in the 21st century receive some form of postsecondary education and/or training. Tech prep must provide integrated secondary and higher education systems that help students pursue lifelong education and training in spite of such potential obstacles as Carnegie units, admission criteria, and

credit transfer. For example, the Carnegie unit has increasingly transformed itself into a restraint on teaching and learning. It perpetuates breadth instead of depth by assigning value to courses based on their labels, rather than actual content.

Another potential barrier is the questionable validity of performance assessments. Performance assessments, ranging from writing essays to designing and conducting experiments and demonstrations or creating portfolios, require students to create answers or products that demonstrate their knowledge or skills. This hands-on, formative approach to assessment provides ongoing feedback to students, teachers, and parents against a set of performance standards instead of against a peer group. However, the use of authentic assessments has raised new questions of subjectivity, fairness, and validity due to there being more than one possible answer. It is this wide range of "possible answers" that raises questions of subjectivity, fairness, and credible documentation of knowledge.

Transforming traditional teaching into modern facilitation of learning within classrooms or workplaces is not an easy nor instant feat. For example, traditional subjects such as algebra and geometry are still taught separately, as if they have nothing to do with each other—a disincentive to interdisciplinary studies (Maeroff 1993). ***Peak Learning*** (Gross 1991, p. 35) outlines what leading experts suggest that education should become in order to reflect what is known about the human brain. Table 3 outlines the emphases of traditional versus modern learning.

In a world that is constantly changing, there is no one subject or set of subjects that will serve you for the foreseeable future, let alone for the rest of your life. The most important skill to acquire now is learning how to learn.

John Naisbitt

Initial responses to reforming teaching and learning are superficial or stop-gap measures such as changing course titles or redesignating which classes particular groups of students take. However, "simply changing the course in which students are enrolled does not change the fact that most teachers have never been taught how to teach in a way that engages a diverse student population in a variety of interesting and important learning activities structured to develop the inherent critical thinking and problem-solving abilities of all students" (Seely 1993, p. 43).

Table 3
Comparison of Traditional and Modern Learning

Traditional learning emphasizes—	Modern learning emphasizes—
1. Memorization and repetition	1. Excitement and love of learning
2. Linear and concrete intellectual development	2. Total human capacity in ethical, intellectual, and physical development
3. Conformity	3. Diversity and personal esteem
4. Individual/competitive efforts	4. Cooperative/collaborative efforts
5. Static and rigid processes	5. Thinking, creativity, and intuition
6. Content learning	6. Process learning of high quality content
7. Teachers as information providers	7. Teachers as learning facilitators
8. Departmentalized learning	8. Interdisciplinary learning
9. Cultural uniformity	9. Cultural differences and commonalties
10. Isolated teaching environments	10. Collaborative teaching environments
11. Technology as an isolated tool	11. Technology as an integral tool
12. Restricted use of facilities	12. Flexible use of facilities
13. Parental involvement	13. Extensive parental partnerships
14. Autonomy of the community	14. Community partnerships
15. The industrial age	15. An information/learning society

Tech Prep Teams

Q: Why Are Tech Prep Teams Important?

A: Building collaboration among parents, students, educators, and business, industry, and labor representatives is imperative to tech prep success. Collaboration is a mutually beneficial, dynamic partnership among two or more entities to achieve common goals. Collaboration is facilitated by involving stakeholders in the (1) identification of content standards; (2) design of curriculum projects; (3) hosting of work site experiences for teachers and students; (4) setting of performance standards; (5) recognition of industry-based tech prep credentials; and (6) institutionalization of tech prep in the community's educational delivery system. In order for systemic change to become institutionalized, people must see enduring personal rewards that will not be abandoned when the next reform comes along. Hence, teamwork is essential to tech prep's collaborative structure.

Q: Who Should Be on Tech Prep Teams?

A: The authors of the Tech Prep Education Act believed that teams are so important that they specified the establishment of consortia as the organizing entity for planning and conducting tech prep. A consortium team consists of individuals and organizations who have combined their knowledge, skills, and resources to accomplish together what they cannot do alone. Tech prep consortia should minimally include representatives from secondary and postsecondary institutions offering technical education programs and from business, industry, and labor. Within each consortium, a number of teams are needed to accomplish specific tasks attached to the common vision and goals of tech prep. These teams cannot be legislated or purchased, but are formed by the collaborative efforts of individuals and/or organizations pursuing common goals. Teams not only stand the test of time, but the winds of change and the lack of financial support from beyond their bounds.

Key and Key (1992) recommend that 50 percent of the tech prep consortium be composed of business, industry, labor, and community-based representatives in order to facilitate planned change. This is critical due to the lack of long-term federal financial support that is expected. Tech prep must seek to collaborate with agencies that offer opportunities to share risks, pool resources, disperse leadership, and accomplish more as a team. The remaining 50 percent of tech prep success depends on extensive cooperation between secondary and postsecondary educators from both academic and vocational-technical program areas. The integration of academic and vocational-technical education provides students with the knowledge and skills needed for continued learning in both work and educational settings. Applications in science (i.e., biology, chemistry, physics, environmental science, anatomy and physiology), mathematics (i.e., algebra, geometry, trigonometry, and calculus), and communications (i.e., reading, writing, speaking, and listening) must be developed collaboratively among secondary and postsecondary faculty.

Q: Where Should Tech Prep Teams Be Formed?

A: Tech prep programming requires interdisciplinary, interlevel, and interagency collaboration at all educational levels. Changes in teaching and curricula are underway at the secondary level, but are moving at a slower pace at the community college level. Hence, the American Association of Community Colleges (AACC) and the Boeing Company convened university, community college, secondary school, business, industry, labor, and federal government leaders in occupational education at the Tech Prep Roundtable. Six of the 19 recommendations specifically addressed the integration of secondary and postsecondary education (Falcone and Mundhenk 1994, pp. 10-18):

- A core curriculum that includes both academic and technical education courses should be developed in collaboration with high school and community college instructors and curriculum specialists. The core curriculum should be common to all occupational programs, although the technical courses might vary between career pathways.

- Community college TPAD curricula should be developed in collaboration with both high school instructors and representatives from the business community. The curricula should be sequenced and should avoid needless overlap.

- A bridge curriculum should be designed to provide for adult entry into technical programs. This bridge should be based on the academic, technical, pedagogical, and counseling components of the high school program that have been articulated with the community college technical program.

- Business and industry representatives should be included as full partners with high school and college personnel in assessing program need, developing program curriculum, and in assessing program effectiveness.

- The TPAD program should be viewed as an essential part of any new school-to-work transition program. Community college officials should join with local and state government officials, business community representatives, and high school officials to assure that these programs work together, rather than in competition with each other.

- Community college presidents should provide the leadership for the development of TPAD programs on their campuses and their feeder high schools. They should be highly involved in educating the college community, in marketing, in making the necessary connections with area high schools and businesses, and in assigning adequate resources.

Q: How Should Tech Prep Teams Function?

A: Successful tech prep teams are structured to have clearly defined and interrelated roles that constitute a fair and equal division of labor. Each team member represents an organizational entity within a collaborative organization with a common vision and set of goals. A jointly developed strategic plan is key to collaboration and guides the measuring of success in terms of the needs of those served. Tech prep teams need many levels of communication, which are critical to survival as a joint

The dogmas of the quiet past are inadequate for the stormy present and future. As our circumstances are new, we must think anew, and act anew.

Abraham Lincoln

organization. Successful teams pool or secure resources jointly toward multiple projects with long-term rewards. Authority is determined by balanced ownership among the organizations represented and leadership is shared so that the risk is equal among partners. Most important, teams provide everyone a chance to contribute, learn, and achieve.

Tech Prep Evaluation and Planning

Q: What Is the Role of Strategic Planning and Evaluation in Tech Prep?

A: In a 1993 interview, Labor Secretary Robert Reich gave the following response to this question: "If the wand were totally yours, how would you reorganize vocational/occupational education?"

> America needs a national school-to-work transition system. . . . My vision is to build local community learning systems around the nation to drive vocational/occupational education. These community learning systems would be dedicated to reconciling the worlds of school and work. They would involve secondary and postsecondary educators, businesses, labor, community groups, parents and students in the process. The new system would build on and enrich Tech Prep, career academies, cooperative education, youth apprenticeship, business-education compacts, and school-to-apprenticeship compacts. Workplaces would be transformed into learning centers. Students not college-bound would leave school fully prepared with academic skills and occupational skills needed in today's workplace and be guided into high-wage, high-skill careers with the same attention now given college-bound students. (Slater 1993, p. 1)

Without a strategic plan, Reich's vision of a national school-to-work transition system will have a difficult time being realized. Strategic planning is required for visions to be realized, goals and objectives to be met, and educational reform to succeed. Strategic planning requires time, critical thinking, reflection, and new approaches. Strategic planning is necessary to articulate tech prep's vision, evaluate tech prep's goals and objectives, and enable each stakeholder group to facilitate systemic change.

The *1994 National Assessment of Vocational Education (NAVE) Report* recommendations suggest elements of a strategic plan that would not only strengthen tech prep evaluation and planning, but also enhance a national school-to-work system (Boesel and McFarland 1994, p. 38):

- **A call for standards**. The new Perkins Act should continue to support tech prep programs, but should require states to verify that Title III grant recipients are building comprehensive, structured tech prep programs that (1) meet the current Perkins definition of tech prep, including the goal of a postsecondary degree; (2) are articulated at the program or industry level; and (3) formally enroll, enumerate, and follow the progress of tech prep students.

- **A call for inclusion**. To ensure equity, states and districts should place greater emphasis on preparing special population students to participate and succeed in tech prep programs.

- **A call for accountability**. The government should conduct rigorous evaluations of tech prep programs. The evaluations should assess program effects on outcomes such as student competencies, transition to postsecondary institutions, attainment of postsecondary credentials, and subsequently employment and earnings.

In compliment to the NAVE Report, two of the Tech Prep Roundtable/American Association of Community Colleges recommendations address the need for strategic planning (Falcone and Mundhenk 1994, pp. 10-18):

- A comprehensive Tech Prep Associate Degree (TPAD) program marketing strategy should be designed that targets students, parents, employers, local and state government officials, and the general public.

- Community college governing boards should take a lead role on behalf of their states and communities in advocating for the establishment and effective delivery of TPAD programs. Boards should provide an appropriate policy framework in support of TPAD program and presidential leadership, and undertake efforts to ensure that adequate support and resources are provided.

Q: Who Should Be Involved in Tech Prep Evaluation and Planning?

A: Tech prep leadership regarding evaluation and planning is pivotal at all levels, but of the utmost importance at the state level. State leadership gives tech prep the stability it needs to be credible at the consortium and district level. In regard to planning, state leadership should focus its attention on the (1) need to prepare individuals for the high performance workplace; (2) development of lifelong learning skills; (3) evaluation of present practices and movement toward future goals; (4) trial of a set of core courses for teacher preparation focusing on new educational priorities, structures, and behaviors; and (5) adoption of a pedagogical model of interdisciplinary approaches to teaching and learning that integrates academic and vocational-technical education across both secondary and higher education systems. As tech prep begins to mature, each stakeholder needs to "be more aware of the double nature of every action we take: every question, response, comment, and assignment not only carries a main message but a side-message, too, about our attitudes toward learning, thinking, and the minds of others" (Perkins 1993, p. 99).

Current research is extremely useful to leaders facilitating tech prep evaluation and planning. However, the majority of tech prep research to date seems either too broad based or somewhat limited in size, and to have used "known" contacts rather than randomly selected individuals or groups. Hence, more quantitative and qualitative research should be conducted in the following areas:

- sustained public support from business, industry, and labor;
- advanced skills that result from seamless curricula crossing secondary and higher education systems;
- classroom implementation of contextual teaching and learning against performance-based standards;
- the role that strategic plans have played in policy alignments at the consortium, state, and district levels;

- the effect of industry-driven career credentials on tech prep placement rates;
- the types of professional development leading to successful tech prep implementation; and
- the development of successful alternative assessments.

A qualitative study will also need to be conducted when a significant number of students have completed the postsecondary portion of the tech prep program. A synthesis of the "action research"—both individual and collaborative—being conducted across the country would also be very beneficial.

Q: How Should Tech Prep Evaluation and Planning Be Done?

A: Evaluation and planning should be a key component of tech prep from the point of conception. Both formative and summative assessments need to be conducted during the development and implementation of tech prep. Dutton et al. (1994) identify five vital elements for evaluation: (1) administrative commitment; (2) training of key personnel; (3) a set of clearly defined and understood goals; (4) access to student data; and (5) an evaluation team that includes representatives of all stakeholders.

Different kinds of evaluative data must be identified and collected. Both qualitative and quantitative data from multiple sources are needed. Information on the following performance indicators should be gathered: course enrollments; program completion rate; job placement; number of articulated courses; student progression rate; employer satisfaction with graduates; numbers of transfers from secondary to postsecondary; student attainment of technical, academic, and interpersonal skills; and use of counseling services (Dutton et al. 1994; Ruhland 1994).

Q: Why Are Tech Prep Evaluation and Planning Important?

A: Tech prep is embraced by more than 1,000 consortia across the country (Falcone and Mundhenk 1994, p. 9). However, it is

important to note that the majority of tech prep consortia that have been funded with 1990 Perkins Act funds are entering only their fifth year of existence. Many people question the success of tech prep due to the low numbers of students that can be identified as tech prep, have entered the postsecondary portion of tech prep, and have completed the entire tech prep sequence.

Tech prep is increasingly making inroads into the hierarchy of education, yet significant long-term benefits will not become evident for several more years. To document these benefits, tech prep programs must continue to acquire student and program outcome data, while focusing on the development of necessary contextual knowledge and skills for successful employment in a global economy.

The advantages and disadvantages of the models identified by Hershey et al. (1995)—depicted in Table 2 on page 11—present significant issues to guide evaluation and planning. Careful evaluation and planning efforts around the following questions can affect the longer-term strength of tech prep implementation (ibid.):

1. For whom is tech prep intended?
2. How central is articulation to tech prep development?
3. How can consortia make programs of study a meaningful feature of tech prep?
4. What are the implications of alternative strategies for introducing applied academic instruction?
5. How much will tech prep change postsecondary programs?
6. What contributions can be expected of employers?

Technology is transforming industry into high-tech, intensive, human capital enterprises in which management layers disappear as skilled technicians complete tasks formerly performed by dozens of unskilled individuals. Students can no longer be counseled or admitted into courses or programs categorized for those who "think" and those who "work." Life is a blend of both. Tech prep has brought both solutions and challenges—each bearing opportunities for lifelong learning.

And one ought to consider that there is nothing more difficult to pull off, more chancy to succeed in, or more dangerous to manage, than the introduction of a new order of things.

Niccolo Machiavelli

Foreground

Q: When Will Tech Prep Yield Results?

A: The federal definition of tech prep should have served as the root system for the transformation trees yet to be planted. However, that definition has been interpreted differently in at least three dimensions—the grade-span affected by tech prep, the development of a defined core program in which all secondary tech prep students are expected to participate, and the ways in which consortia define a tech prep student. According to national data collected by Mathematica Policy Research, Inc. (Silverberg and Hershey 1995):

1. **Most consortia report models for tech prep that begin earlier and extend later than . . . a 2+2 program.** In Fall 1993, 60 percent of consortia reported that they were working toward a tech prep model that includes 10th grade or 9th and 10th grade. Almost two-thirds of all consortia reported that their program design includes options for transfers from community colleges to four-year colleges.

2. **In about three-fourths or more of all consortia that have consortium-wide definitions of a core program,** tech prep students are expected to do one or more of the following: (1) develop a plan of study; (2) choose a broad career cluster; (3) take or complete one or more applied academic courses; (4) take required academic or occupational courses related to a career cluster, or take a minimum number of such courses as electives; (5) participate in career awareness/development activities.

3. **In Fall 1993, more than 70 percent of the consortia reported having a definition of which secondary students are to be counted as "in tech prep."** In about 10 percent of these consortia, each participating school or district determined its own definition. Consortia reported 18 combinations of four criteria for counting participation—student's choice of tech prep as a path, development of a 4- or 6-year student plan, vocational course taking, and taking applied academics classes.

This broad variance across consortia offers many different definitions and leads the general public to question "What exactly is tech prep?" The lack of a unified answer stands in the way of clear marketing strategies and valid forms of accountability.

Research completed to date supports the seven propositions that resulted from a 3-day summit co-sponsored by the Institute on Education and the Economy and the National Center for Research in Vocational Education (Ascher and Flaxman 1993, pp. 8-16):

1. Integration and tech prep face a number of structural and professional obstacles in meeting their instructional goal of an integrated academic and vocational curriculum.

2. The historic division of the high school into classes for college-bound and noncollege-bound students makes the promise of integration and tech prep to end tracking difficult to achieve.

3. Workplace learning, increasingly viewed as a critical component of programs for improving students' transition from school to work, will succeed only if business and industry become full partners.

4. For integration and tech prep to demonstrate success, new kinds of standards and new tools for evaluation must be developed.

5. New strategies for professional development must be created to support these reforms.

6. Integration and tech prep changed guidance and counseling practices in the schools through the curriculum, altered counselor roles, and caused greater involvement of other school staff and outsiders.

7. Both integration and tech prep can be either facilitated or hindered by the policy and political environment in which they are implemented.

These seven propositions have massive implications for changes in educational policy at the federal, state, and local levels. Yet, even if policies are altered to address these propositions, "another hurdle to overcome is the funding needed to achieve systemic reform. We are challenged to sustain our educational initiatives while our states are facing significant financial constraints. While money is not the answer, it is a tool in systemic change. And it should be noted that citizens' support for government spending is significantly higher when those revenues are targeted for improved educational outcomes" (National Governors' Association 1992, p. 6). Whether tech prep focuses on the neglected majority, nontraditional adults, worksite learning, or individuals in pursuit of a postsecondary degree, they can help direct "real world" reform. Technology, the economy, and public/private policy are inseparable from education. Tech prep is currently harvesting trees by joining the forces of technology with secondary and postsecondary education and business, industry, and labor to offer expanded opportunities to the future work force.

Q: Where Is Tech Prep Headed?

A: As tech prep's forest continues to grow, each tech prep tree should be examined to determine its future health. The following checklist of queries might be helpful.

Queries	Yes	No
1. Do parents, educators, and business, industry, and labor members share the responsibility for moving students across the bridge from school to work?	☐	☐
2. Is your environment one that encourages each stakeholder to be		
(a) treated with constant respect;	☐	☐
(b) conversant about implementation plans before action is taken; and	☐	☐
(c) recognized as both an individual and group contributor to the tech prep initiative?	☐	☐
3. Is there a set of clear and consistent signals and incentives for integration that reward both secondary and postsecondary academic and vocational-technical educators who meet or exceed those standards?	☐	☐

Queries	Yes	No
4. Do educators, as well as business, industry, and labor representatives collaboratively agree on the knowledge and skills required to cross the bridge from school to work, and to partner in the development of interdisciplinary tech prep curriculum?	☐	☐
5. Have credible career credentials been established that are		
(a) promoted by informed counselors and admissions officers;	☐	☐
(b) reflective of the knowledge and skills needed by employers; and	☐	☐
(c) recognized by business, industry, and labor as meeting the needs of a changing labor market?	☐	☐
6. Have shared goals such as these been agreed to by the consortium:		
(a) All students can learn;	☐	☐
(b) Curriculum, assessment, and professional development are aligned to deliver challenging content in authentic ways;	☐	☐
(c) Students can achieve higher curriculum standards;	☐	☐
(d) Accountability measures must address curriculum standards; and	☐	☐
(e) Policy changes will reflect the desired higher standards?	☐	☐
7. Has the infrastructure needed for systemic educational reform be established by the		
(a) provision of resources of time, energy, personnel, materials, and money;	☐	☐
(b) built-in capacity for local improvement; and	☐	☐
(c) elimination of bureaucratic constraints in order to provide the flexibility necessary to enable students to reach higher standards?	☐	☐

Queries	Yes	No
8. Is there meaningful private sector participation in the		
(a) identification of content standards;	☐	☐
(b) design of curriculum projects;	☐	☐
(c) hosting of worksite experiences for teachers and students;	☐	☐
(d) setting of performance standards;	☐	☐
(e) recognition of industry-based tech prep credentials; and	☐	☐
(f) institutionalization of tech prep in the community's educational delivery system?	☐	☐
9. Have performance standards been established that will equip students with the knowledge, skills, and attitudes needed for employment in technician-level positions and the lifelong learning skills needed to retrain as job market requirements change?	☐	☐
10. Has strategic planning been completed that enables		
(a) articulation of the tech prep vision;	☐	☐
(b) evaluation of tech prep goals and objectives; and	☐	☐
(c) the roles and responsibilities of each stakeholder group to facilitate systemic change?	☐	☐
11. Is tech prep leadership focused on the		
(a) need to prepare individuals for the high performance workplace;	☐	☐
(b) development of lifelong learning skills;	☐	☐
(c) evaluation of present practices and movement toward future goals;	☐	☐
(d) trial of a set of core courses for teacher preparation focusing on new educational priorities, structures, and behaviors; and	☐	☐
(e) adoption of a pedagogical model of interdisciplinary approaches to teaching and learning that integrates academic and vocational-technical education across both secondary and higher education systems?	☐	☐

Queries	Yes	No
12. Is stakeholder feedback		
(a) requested at the idea stage of an initiative;	☐	☐
(b) received as soon as possible following actions;	☐	☐
(c) part of an ongoing process; and	☐	☐
(d) specific and accountable for guiding future behavior?	☐	☐
13. Are secondary and higher education systems integrated enough to help students pursue lifelong education and training in spite of bureaucratic policies such as Carnegie units, admission criteria, and credit transfer?	☐	☐
14. Is a cohesive professional development plan for teachers, counselors, and administrators in place that is structured around these principles:		
(a) learners are active receivers and providers of wisdom;	☐	☐
(b) knowledge and skills should be acquired in context;	☐	☐
(c) getting the right answer is not the purpose of learning; and	☐	☐
(d) pieces of learning need to be seen as important to the whole?	☐	☐
15. Have learning communities been established with		
(a) student-centered curricula;	☐	☐
(b) clear evidence of the necessity to become lifelong learners; and	☐	☐
(c) continuity between what students learn in school and what employers will expect of them in the workplace?	☐	☐
16. Are students provided opportunities to learn and achieve at the levels needed to reach the national goal of preparing students for responsible citizenship, lifelong learning, and productive employment in a global economy?	☐	☐

Q: Why Should Tech Prep Continue?

A: Change is critical to realizing the goals currently in place for the U.S. educational system. Systemic change is not tinkering around the edges, using buzzwords, or just doing the same things in a different manner. It is not a top-down or bottom-up process; it is all encompassing. Perhaps the best analogy is the example of a farmer in 1890 who wished he had a plough horse that was twice as strong and twice as fast, but ate half as much oats. Unfortunately, he never thought to "invent" a tractor. That is comparable to the leap forward we must seek in education. To support the infrastructure needed for systemic educational change, local, state, and federal entities must collaborate on the following tasks: (1) provide the time, personnel, materials, and dollars needed; (2) build capacity for local improvement; and (3) eliminate bureaucratic constraints in order to offer the flexibility necessary to enable students to reach higher standards.

Tech prep is only one of the key components of systemic change desired for U.S. education. There is no one single key, but rather a set of keys—including some not yet "invented"—that will unlock the potential of the nation's children, schools, colleges, universities, places of employment, and communities at large. Systems thinking prescribes that no one aspect of a system can be changed in isolation because component parts must be coherent if that system is to improve dramatically. Thus, the combined result of tech prep and other educational innovations can be expected to occur incrementally and their impact assessed on cumulative outcomes.

Tech prep is only one of the key components of systemic change desired for U.S. education.

Leadership for change must come from tech prep stakeholders—parents, students, teachers, administrators, school counselors and college admissions officers, university teacher educators, business, industry, and labor representatives. With knowledge doubling every year or so, "expertise" now has a shelf life measured in days. Everyone must be both learner and teacher, and the sheer challenge of learning can be managed only through a globe-girdling network that links all minds and all knowledge. Now learning is literally the work of the majority of U.S. jobs and will be what virtually all adults—whether

employed, unemployed, or "on welfare"—will do for a living by the early years of the 21st century (Perelman 1992). Tech prep can embrace its opportunity to transform education by creating—

- an *awareness* of the need to prepare individuals for the high performance workplace;
- an *interest* in the development of lifelong learning skills;
- an *evaluation* of present practices and movement toward future goals;
- the *trial* of a pedagogical model of interdisciplinary approaches to teaching and learning that integrates academic knowledge and vocational-technical skills across both secondary and postsecondary delivery systems; and
- the *adoption* of a set of core courses for teacher preparation focusing on new educational priorities, structures, and behaviors.

Successful tech prep consortia are bound by a set of shared goals that center their conversations, actions, and progress. "With systemic, fundamental change that is meaningful and that the school community itself has worked to create, restructuring appears to hold great promise for . . . a radically different, post-industrial, information age" (Norris and Reigeluth 1991, p. 11). Tech prep can and will continue to be a directive for teaching and learning in context, interdisciplinary applications of academics for technical occupations, a connected pathway between secondary and postsecondary education, lifelong learning, and critical employability skills such as teamwork. Tech prep is engaging students who have typically been neglected by the educational system and encourages them to pursue further education *and* rewarding work. Tech prep provides opportunities for these students to learn and achieve at the levels needed to reach the nation's goal of preparing people for responsible citizenship, lifelong learning, and productive employment in a global economy.

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Tech Prep Resources

Anderson, L. D. "Implementing the Technology Preparation (Tech-Prep) Curriculum." ***Journal of Technology Studies*** 21 no. 1 (Winter-Spring 1995): 48-58.

Tech prep programs are built on the premise that youth must become involved in the development of a technological society. Several models for integrating tech prep with academic education hold promise.

Bragg, D. D. "Tech Prep: Where Are We Now?" ***Vocational Education Journal*** 70, no. 4 (April 1995): 18-23.

Looks at fundamental tech prep concepts that must be reinforced to ensure progress: (1) it must be grounded in an integrated curriculum; (2) articulation is necessary; (3) school-to-work programs and tech prep must be linked; (4) it should be outcomes focused; (5) it should ensure access for all; and (6) collaborative implementation is the foundation.

Bragg, D. D., and Layton, J. D. "Tech Prep Implementation in the United States: The Once and Future Role of Community Colleges." ***Community College Review*** 22 no. 4 (Spring 1995): 3-16.

Based on telephone survey responses from all 50 state tech prep leaders, reviews study findings concerning the funding of tech prep consortia, state and local administrative structures, policies and goals, and barriers to implementation.

Bragg, D. D. et al. ***Building a Preferred Future with Tech Prep Systems***. Berkeley, CA: National Center for Research in Vocational Education, October 1994. (ERIC Document Reproduction Service No. ED 375 297)

This document is designed to help local practitioners construct new tech prep systems that bridge the federal Tech Prep Education Act with the new School-to-Work Opportunities legislation. Its sections include a historical and philosophical foundation for new systems; a rationale for creating new systems; core

concepts; and perspectives, processes, and strategies for planning, implementing, and evaluating tech prep. A national tech prep experts contact list is included.

Bucci, P., and Lee, J. B. ***PACE Model Tech Prep Education Project. Evaluation Report***. Washington, DC: Academy for Educational Development, Inc.; Pendleton, SC: Partnership for Academic and Career Education, June 1995. (ERIC Document Reproduction Service No. ED 383 899)

The effectiveness of the Partnership for Academic and Career Education (PACE) model tech prep initiative was evaluated in a 2-year study conducted by the Academy for Educational Development. Information for the evaluation was collected through site visits and surveys administered to students, faculty, and staff at the schools. The surveys and site visits confirmed the PACE model's claims that students will be more motivated in tech prep and that staff in tech prep schools will see better results.

Coffey, D. M., and Brannon, T. "Tech Prep—Lessons Learned." ***Agricultural Education Magazine*** 66, no. 11 (May 1994): 21-23.

Lessons learned in guiding effective tech prep programs in agriculture include the constraints of Perkins funding, importance of the coordinator, necessity of continuous curriculum effort, teacher acceptance, pitfalls of articulation agreements, avoidance of remedial education, tech prep's place in overall reform, and emphasis on comprehensive life skills.

Developing Tech Prep Guidance Programs. Seattle Tech Prep. Seattle, WA: Seattle Community College District; Seattle Public Schools, 1994. (ERIC Document Reproduction Service No. ED 383 831)

This publication provides information on the strategies used by Seattle (Washington) Public Schools' counseling service and tech prep counselors to integrate the tech prep concept into comprehensive counseling activities. It begins with a rationale for tech prep and information on enrollment. Six strategies are detailed and information about guidance activities and goals are also included.

Dykman, A. "What School-to-Work Means for Tech Prep. States Have Differing Views on Their Coordination." ***Vocational Education Journal*** 70, no. 4 (April 1995): 24-25, 44.

Survey responses from 42 of 50 state directors of vocational-technical education revealed the following: most agreed that tech prep is one option within school-to-work; tech prep's identity needs to remain strong; cooperation is needed; and coordinators are worried about the potential loss of funding.

Gugerty, J. "Making Tech Prep and School to Work Realistic Options in Transition Planning." Paper presented at the Annual International Convention of the Council for Exceptional Children, Indianapolis, Indiana, April 1995. (ERIC Document Reproduction Service No. ED 384 197)

Information on the following topics is outlined: seven essential elements of tech prep; amendment to tech prep contained in Title VII(B)711(a) of the School-to-Work Opportunities Act, PL 103-239; Wisconsin definition of tech prep and a definition of "equitable participation"; tech prep implementation; facilitators and barriers to enrolling students with disabilities in tech prep; what is needed to help enroll students with disabilities in tech prep; eight titles of the School-to-Work Opportunities Act (STWO) of 1994; descriptions of the STWO school-based learning component, work-based learning component, and connecting activities component; governance; types of STWO grants; and information on states receiving STWO grants.

Hayes, R. et al. "The Condition of Tech Prep." ***Tech Directions*** 54, no. 6 (January 1995): 10-18.

Includes "State Tech Prep Initiatives—A National Survey" (Hayes); "Tech Prep Evolves in Indiana" (Adcock, Suba); and NAIT (National Association of Industrial Technology) Accreditation—Tech Prep's Final + 2 Link" (Shaw).

Hershey, A.; Silverberg, M. K.; and Owens, T. ***The Diverse Forms of Tech-Prep: Implementation Approaches in Ten Local Consortia***. Princeton, NJ: Mathematica Policy Research, 1995. (ERIC Document Reproduction Service No. ED 384 750)

This document profiles the diverse approaches to tech prep taken by 10 local districts across the United States. Each profile includes information about the following aspects of the program: articulation and programs of study; changes in curriculum and instruction; recruitment, guidance, and career development; and governance and resources. The final chapter discusses the following emerging issues: students toward whom tech prep is targeted; the importance of articulation to tech prep development; ways consortia can make programs of study a meaningful feature of tech prep; the implications of alternative strategies for introducing applied academics; the extent to which tech prep will change postsecondary programs; and the role business and industry can be expected to play in tech prep.

Higginbottom, G. H. "Workplace Utility and the Humanities: General and Occupational Education in the Community College." ***Journal of General Education*** 43, no. 4 (1994): 273-288.

Questions the merit of workplace utility as a criteria for general and occupational curricula, focusing on community colleges and the current trend toward tech prep curricula. Urges general education advocates to uphold the integrity of a broadly useful humanities education, while actively promoting vocational education for a well-prepared work force.

Horan, M. J. ***Community College Reform and Tech Prep: Leading, Following, or Business as Usual?*** Unpublished paper, 1995. (ERIC Document Reproduction Service No. ED 377 914)

Reports on the results of a recent survey of 22 Florida community colleges in their second, third, or fourth year of tech prep funding. Results suggest that the initiative has not yet begun to produce the systemic curriculum reform that is underway at the secondary level. Specifically, the survey found that, with respect to the colleges' belief that "common core" courses paralleling secondary applied academic courses were appropriate for high school tech prep completers as currently offered, 82% (n=18) felt they were for Freshman Composition and 68% (n=15) felt so for algebra. Further, 68% of the colleges felt that it was better to modify existing courses by infusing competencies and applied teaching methodologies than developing

separate courses for tech prep secondary completers. Only 23% of colleges reported that they had modified one or more "common core" courses.

Lankard, B. A. ***Tech Prep. Myths and Realities.*** Columbus: ERIC Clearinghouse on Adult, Career, and Vocational Education, Center on Education and Training for Employment, The Ohio State University, 1995. (ERIC Document Reproduction Service No. ED 378 423)

Reviews three misconceptions about tech prep (tech prep is an integration of academic and vocational education, tech prep is an articulation agreement between high schools and colleges, and tech prep is a 2 + 2 program that cannot include formal apprenticeship training) and refutes each by describing the reality.

Logan, J., and Briscoe, M. "Kentucky's Evaluation System for Tech Prep Programs and Data Reported by Secondary and Postsecondary Kentucky Tech Prep Programs in 1993." Paper presented at the American Vocational Association Convention, Dallas, TX, December 1994. (ERIC Document Reproduction Service No. ED 379 423)

Describes the Kentucky Tech Prep Evaluation system that was developed to establish and maintain a database and data analysis for assessment of the effectiveness of tech prep programs in achieving specific goals and in helping schools improve cognitive and noncognitive performance as reflected in the Kentucky Instructional Results Information System (KIRIS) accountability system. The evaluation system is designed to determine over a 3- to 5-year period how tech prep is affecting students' test results and the school-to-work transition. The tech prep evaluation system is based on secondary and postsecondary survey forms that were tested at five pilot sites in metropolitan and rural school districts throughout the state.

Lozada, M. et al. "The Payoff. Tech Prep Efforts Are Beginning to Show Dividends in Students Like These." ***Vocational Education Journal*** 70, no. 4 (April 1995): 34-36.

Three articles show what tech prep can mean for young people preparing for the world beyond high school: "Cultivating Potential, Academy Style" (Lozada); "A Path Out of Poverty for

Oklahoman" (Killackey); and "An 'A' Student Who Found Tech Prep the Right Fit" (Dykman).

MacQueen, A. B. "Assessing Tech Prep. A Rhode Island Perspective." Paper presented at "Workforce 2000," the Annual Conference on Workforce Training of the League for Innovation in the Community College, San Diego, California, February 1995. (ERIC Document Reproduction Service No. ED 380 155)

Describes an assessment of Rhode Island's tech prep consortium that was developed by the Community College of Rhode Island (CCRI), in collaboration with the Rhode Island Department of Elementary and Secondary Education and that introduced tech prep to over 75% of the high schools statewide. Data about the results of the Tech Prep Associate Degree (TPAD) program were collected through an examination of school records; on-site, informal interviews; and random telephone surveys. Study findings included the following: (1) although TPAD students scored significantly lower than the comparison group prior to their participation in the program, they attained significantly higher grade point averages (GPAs) after their TPAD participation; (2) there was no significant difference between the graduation rates of the TPAD and non-TPAD students; (3) the postsecondary participation rate of TPAD students (60%) was higher than that of non-TPAD students (38.5%); and (4) non-TPAD and TPAD students performed about the same in their first year of postsecondary education.

Nelson, C. H. "Tech Prep in Texas: An Implementation Strategy." ***Community College Journal of Research and Practice*** 18, no. 2 (March-April 1994): 99-112.

Describes the process of developing a long-range plan for the statewide implementation of tech prep associate of applied science (AAS) degree programs in Texas. Suggests that the most critical issues of implementation are effective resource allocation, program access, quality assurance, and building program infrastructure.

Newman, L. "A Comprehensive Tech Prep Curriculum Model." Paper presented at the Annual Collaborative Conference of the California Community Colleges, San Jose, CA, April 1994. (ERIC Document Reproduction Service No. ED 369 448)

Describes the Butte College Tech Prep Consortium (TPC), in Oroville, California, a cooperative effort of secondary and postsecondary schools, local businesses, and community organizations to develop and implement tech prep opportunities in the area. The TPC has developed a competency-based, comprehensive tech prep curriculum model that is applicable to the differing needs of the institutions involved. Under the model, each participating secondary partner can generate education plans for its students in every program offered by Butte College (BC) and students can develop competencies through a range of courses, workplace experience, or extracurricular activities. The model's curriculum development plan includes the following five steps: (1) secondary schools identify programs they wish to target; (2) teams of consortium partners define competencies for each element in the curriculum; (3) competencies are tied to courses and activities; (4) project participants define and negotiate competency standards; and (5) formal program articulation agreements are established between secondary schools and BC.

Owens, T. R. ***Washington Year Two Tech Prep Planning and Implementation Survey Summary***. Portland, OR: Education and Work Program, Northwest Regional Educational Laboratory, April 1995. (ERIC Document Reproduction Service No. ED 382 860)

Reports on the results of a survey on selected aspects of tech prep planning and implementation on tech prep in the state of Washington. All 19 consortia reporting on the core elements of their tech prep programs required students to complete a student education plan, 18 required students to take vocational-technical courses, and 11 required students to take at least 1 applied academics course. Lack of staff, time, and money dedicated to tech prep and lack of truly integrated curricula were the most commonly perceived program limitations.

Parnell, D. "The Tech Prep Associate Degree Program Revisited." Paper presented at the Annual Conference on Workforce Training of the League for Innovation in the Community College, New Orleans, Louisiana, January 1994. (ERIC Document Reproduction Service No. ED 369 441)

Current education reform efforts show a lack of attention to the three out of four students currently in the educational system who are unlikely ever to earn baccalaureate degrees. The Tech Prep Associate Degree Program (TPAD) is aimed at preparing this neglected majority for the demands of a complex and shifting economy and improving teaching and learning. Early returns from schools that have fully implemented the TPAD program show a definite pattern of improved student learning. Unfortunately, the success of these programs has been nearly ignored in the new national school-to-work emphasis. TPAD should be a key focus of community colleges, as a way to provide a more cost-effective education and as part of a new definition of excellence. TPAD programs benefit students, employers, high schools, community colleges, communities, states, and the nation.

Pianelli, M. A. "Technology Middle College." Paper presented at "Workforce 2000," the Annual Conference on Workforce Training of the League for Innovation in the Community College, San Diego, California, February 1995. (ERIC Document Reproduction Service No. ED 380 177)

Describes Tech Prep Middle College (TPMC), a program designed by the Houston Community College System and the Houston Independent School District to ensure that tech prep reaches at-risk students at the earliest possible stages. TPMC provides high school students with a 6-year program of study beginning in 9th grade and leading to an Associate in Applied Science degree with advanced technology skills. The TPMC features a strong community-based component, encouraging field trips and community service at all levels. In Fall 1994, the TPMC enrolled its first class of 60 students who were 46% Hispanic, 19% Black, and 55% male. Problems encountered by the program included lack of space, improperly designed facilities, and lack of realistic planning beyond the program's first year.

Raber, S. M., and Merchlinsky, S. R. ***An Evaluation of the Southern Maryland Educational Consortium's Tech Prep Program: Final Report***. Bethesda, MD: COSMOS Corp.; La Plata: Southern Maryland Educational Consortium, March 1995. (ERIC Document Reproduction Service No. ED 383 916)

Southern Maryland Educational Consortium's 4 + 2 tech prep program was evaluated by an independent research firm to identify the different strategies being used by the consortium partners and the institutional and student outcomes resulting from implementation. The evaluation entailed case studies of each of three participating school districts with data collection through interviews, surveys, observations and analysis of student outcome data. The following recommendations for future data collection were made: continue to focus on systemic trends, target tech prep students, track tech prep students, and track longer-term outcomes.

Reynolds, J. "Learning Style Characteristics: Implications for Tech Prep." ***Clearing House*** 68, no. 5 (May-June 1995): 317-319.

Defines and discusses applied academics and learning-style characteristics and the integration of learning-style theory and applied academics and their usefulness for tech prep.

Rhode Island Tech Prep Business & Industry Resource Guide. Warwick: Community College of Rhode Island, 1994. (ERIC Document Reproduction Service No. ED 378 349)

This guide provides educators with information about developing partnerships with businesses. It begins with a rationale for forging education-business relationships and highlights benefits to all parties—educators, businesses, and students. Ways in which businesses can contribute and can benefit are outlined. A checklist for developing a business-education partnership program that may be used as the foundation of a school-to-work transition program is provided. The final section focuses on business-education partnerships as a growing component of the Rhode Island Tech Prep Program.

Roberts, P., and Clark, D. "Integrating Technology Education and Tech Prep." ***Technology Teacher*** 53, no. 6 (March 1994): 43-44.

Factors that facilitate the integration of technology education and tech prep include problem-solving emphasis, current mandates, and business/industry linkages. Impeding integration are lack of understanding of the terms, image, tracking, and turf issues. A strong linkage could benefit both as well as students.

Ruhland, S. K. "Tech Prep Decision Making: Evaluation and Improvement Strategies." Paper presented at the Annual Conference of the National Tech Prep Network, Minneapolis, MN, October 1994. (ERIC Document Reproduction Service No. ED 375 296)

Describes an evaluation process that advocates including evaluation in every phase of a tech prep initiative, from needs assessment to completion. The evaluation design should be simple, understandable, and usable; dynamic; proactive; cost effective; quantifiable; transferable; and formative and summative in nature. Examples of program components that may be beneficial to consider when evaluating a tech prep effort are as follows: administration and organization; articulation and collaboration; student program planning and implementation; curriculum development; marketing efforts; program effects; staff development; and evaluation strategies.

Ruhland, S. K.; Custer, R. L.; and Stewart, B. R. "Evolving a Model for Evaluating Tech Prep Implementation." Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, California, April 1995). (ERIC Document Reproduction Service No. ED 384 650)

Proposes an evaluation model that draws on the Context, Input, Process, and Product model of D. L. Stufflebeam. A national survey that yielded 35 replies provided a picture of tech prep in the states, a picture of considerable diversity. The tech prep concepts must be translated to programmatic forms, subject to evaluation and assessment. Multiple means of assessment will be critical to effective program evaluation.

Silverberg, M. K., and Hershey, A. M. ***The Emergence of Tech-Prep at the State and Local Levels***. Princeton, NJ: Mathematica Policy Research, 1995. (ERIC Document Reproduction Service No. ED 384 713)

Reports on the results of a natural survey of tech prep coordinators at the state and local levels. The study established that, although tech prep has the potential to affect many students, tech prep students still represented relatively small proportions of students in their consortium districts. Many consortia were still in a pilot phase. The current level of activity among postsecondary partners was unclear, and reporting on students appeared a major obstacle for consortia and states. Tech prep has already laid some groundwork for transformation to school-to-work systems, however.

Solar Car, Solar Boat: Model Classroom Projects. Seattle Tech Prep. Seattle, WA: Seattle Community College District; Seattle Public Schools, 1994. (ERIC Document Reproduction Service No. ED 383 832)

This booklet shows how teachers at high school and middle schools challenged their students to tackle demanding technical projects. It also shows how well the students responded to that challenge. The booklet begins with the background of the project, the framework for which would be a university-sponsored statewide competition for remote controlled model solar cars. Included are reports written by high school student teams describing their experiences developing solar cars. A description of the middle school solar-powered boat competition is also included.

Stadt, R. W., and Seng, M. P. "Tech Prep: Some Cautions Regarding Program Improvement." ***ATEA Journal*** 21, no. 4 (April-May 1994): 11-12.

Interviews with university, state, and local educators highlighted some of the admirable qualities of tech prep (relevance, value to noncollege-bound students) and some barriers (lack of standards/ guidelines, articulation problems, need for inservice training and employer involvement).

Tech Prep SCANS Lesson Development. Region 10 Tech Prep. Bloomington, IN: Region 10 Tech Prep Consortium, 1994. (ERIC Document Reproduction Service No. ED 374 325)

This document contains 50 applications-based lessons modeled around the SCANS (Secretary's Commission on Achieving Necessary Skills) competencies. Developed by 91 secondary and postsecondary teachers, the applications-based lessons attempt to bridge the gap between school and work and are designed to encourage students to develop specific content skills in English, math, science, business, and industrial technology while getting better at managing resources, working with others, dealing with information, understanding systems, and using technology. The lessons are built around long- and short-term projects. Some of the project topics include the following: calculating interest on investments, designing a school lunch menu, school attendance (statistics), broadcast news, creating a business, autobiographies, finding a job, creating booklets on computers, creating a videotape, student store, money management, and payroll and taxes.

Thuemmel, W. L. et al. "Theme: Tech Prep—Articulation, Curriculum Change, Implementation Strategies." ***Agricultural Education Magazine*** 66, no. 7 (January 1994): 4-15, 23.

Theme issue includes the following: "Tech Prep (TP)—Articulation Check" (Thuemmel); "Delivering an Education That Works" (Perry); "TP: A Flood of Change" (Mahler, Vold); "Implementation Strategies for TP" (Harris, Birkenholz); and "Making Transitions in Agricultural Education through TP" (Sutphin).

Turlington, A. J. ***Designing a Technical Advanced Placement Program. PACE "How To" Handbooks for Tech Prep***. Pendleton, SC: Partnership for Academic and Career Education, December 1994a. (ERIC Document Reproduction Service No. ED 384 715)

This handbook explains how to design a technical advanced placement program. Discussed are the following topics: the need for articulation in tech prep programs, obstacles/controversies regarding articulation, participants in articulation

programs, the granting and use of articulated credit, elements of articulation agreements between high schools and community colleges, articulation of traditional academic courses, and benefits of using the term "technical advanced placement" instead of "articulation." A model for 2+2+2 articulation is presented, and various aspects of 2+2+2 articulation models are considered, including their relationship to tech prep initiatives, benefits to students, chief obstacles, and main components. Tips for designing successful high school-community college articulation programs are provided.

Turlington, A. J. ***Developing a Career Awareness Program for Students. PACE "How To" Handbooks for Tech Prep.*** Pendleton, SC: Partnership for Academic and Career Education, September 1994. (ERIC Document Reproduction Service No. ED 384 769)

This handbook explains how to develop career awareness programs for tech prep students. Included are answers to questions about the need for career awareness programs in tech prep, program components and format, program facilitation, and integration of career awareness activities into applied academics classes. Guidelines for developing a student career awareness program conclude the handbook.

Turlington, A. J. ***Integrating the Curriculum. PACE "How To" Handbooks for Tech Prep.*** Pendleton, SC: Partnership for Academic and Career Education, July 1994c. (ERIC Document Reproduction Service No. ED 384 716)

This handbook explains the process of integrating a tech prep curriculum. Included are the nature of curriculum integration, benefits of curriculum integration to students and teachers, and the link between curriculum integration and tech prep. The various models and types/levels of curriculum integration are outlined, and three model projects/programs in curriculum integration are discussed as possible integration models. Concluding the handbook are general guidelines for developing curriculum integration activities.

Turlington, A. J. ***The PACE Guide to Area Business Speakers. PACE "How To" Handbooks for Tech Prep.*** Pendleton, SC: Partnership for Academic and Career Education, September 1994d. (ERIC Document Reproduction Service No. ED 384 770)

This handbook, explains how to develop a guide to area business speakers. Practical information presented in the guide includes types of information and individuals to include in a speakers' guide, steps in contacting prospects, and use of speakers' guides by teachers and counselors.

Turlington, A. J. ***The "Tech Prep News." PACE "How To" Handbooks for Tech Prep.*** Pendleton, SC: Partnership for Academic and Career Education, October 1994. (ERIC Document Reproduction Service No. ED 384 771)

This handbook uses the PACE publication "Tech Prep News" to illustrate the process of developing a tech prep consortium newsletter. Included are answers to questions about tech prep newsletters including why they should be published, how often, and what they should include. Tips for producing a newsletter conclude the handbook.

Walter, D. M. ***Integrating Work-Based Learning into Comprehensive Tech Prep Programs: Recommendations from a Practitioner's Perspective.*** Pendleton, SC: Partnership for Academic and Career Education, June 1995. (ERIC Document Reproduction Service No. ED 384 717)

This handbook presents 10 recommendations concerning integrating work-based learning into comprehensive tech prep programs. Discussed first are the background research and information that helped shape the recommendations. The remainder of the handbook is devoted to the following specific recommendations: (1) establish a foundation of career information and awareness; (2) provide a variety of options; (3) utilize opportunities beyond work-based learning; (4) establish clear definitions and maintain standards; (5) learn to think and act regionally; (6) be realistic about what to expect from employers; (7) provide students with structured time for reflection; (8) provide opportunities for all students; (9) design real linkages with postsecondary programs; and (10) anticipate the impact of work-based learning on community relations.

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